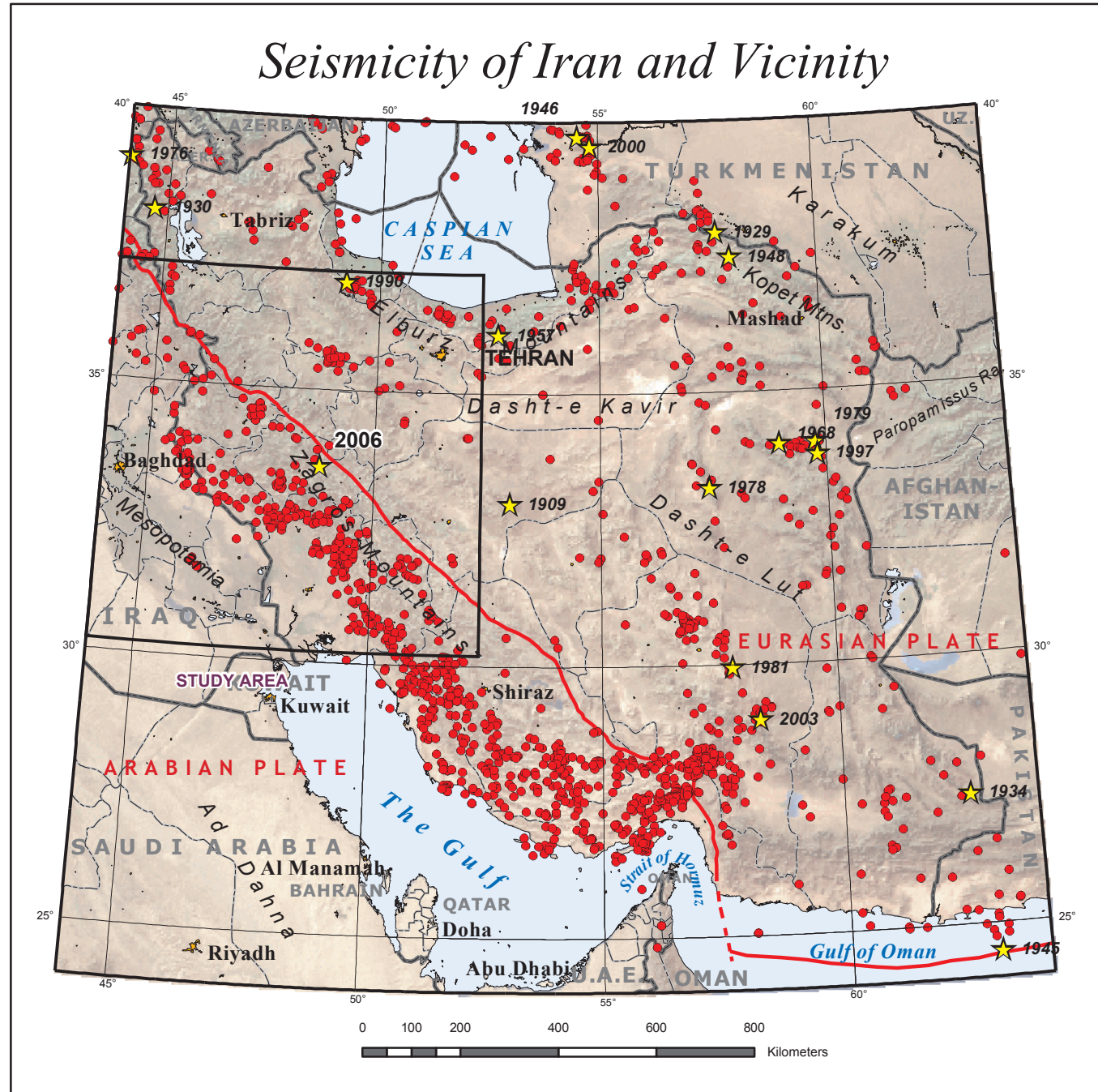


M6.1 Western Iran Earthquake of 31 March 2006



LARGEST EARTHQUAKES, 1900 - 2006					
YEAR	MO	DY	LAT	LON	MAG
1909	1	23	33.000	53.000	7.00
1929	5	1	37.957	57.693	7.10
1930	5	6	38.152	44.685	7.10
1934	6	13	27.428	62.594	7.00
1945	11	27	24.500	63.000	8.00
1946	11	4	39.750	54.500	7.10
1948	10	5	37.500	58.000	7.20
1957	7	2	36.090	52.701	7.10
1969	9	31	34.045	58.960	7.20
1976	11	24	39.083	44.030	7.00
1978	9	16	33.268	57.387	7.40
1979	11	27	34.059	59.757	7.10
1981	7	28	29.964	57.766	7.30
1990	6	20	37.006	49.218	7.40
1997	5	10	33.833	54.796	7.20
2000	12	6	39.566	54.799	7.50
2003	12	26	28.995	58.311	6.80

EXPLANATION

Largest Earthquakes M $\geq$ 7

★ 1900 - 2002

Earthquakes M $\geq$ 5

● 1900 - 2002

Peak Ground Acceleration

0.0 - 0.2 m/sec²

0.2 - 0.4

0.4 - 0.8

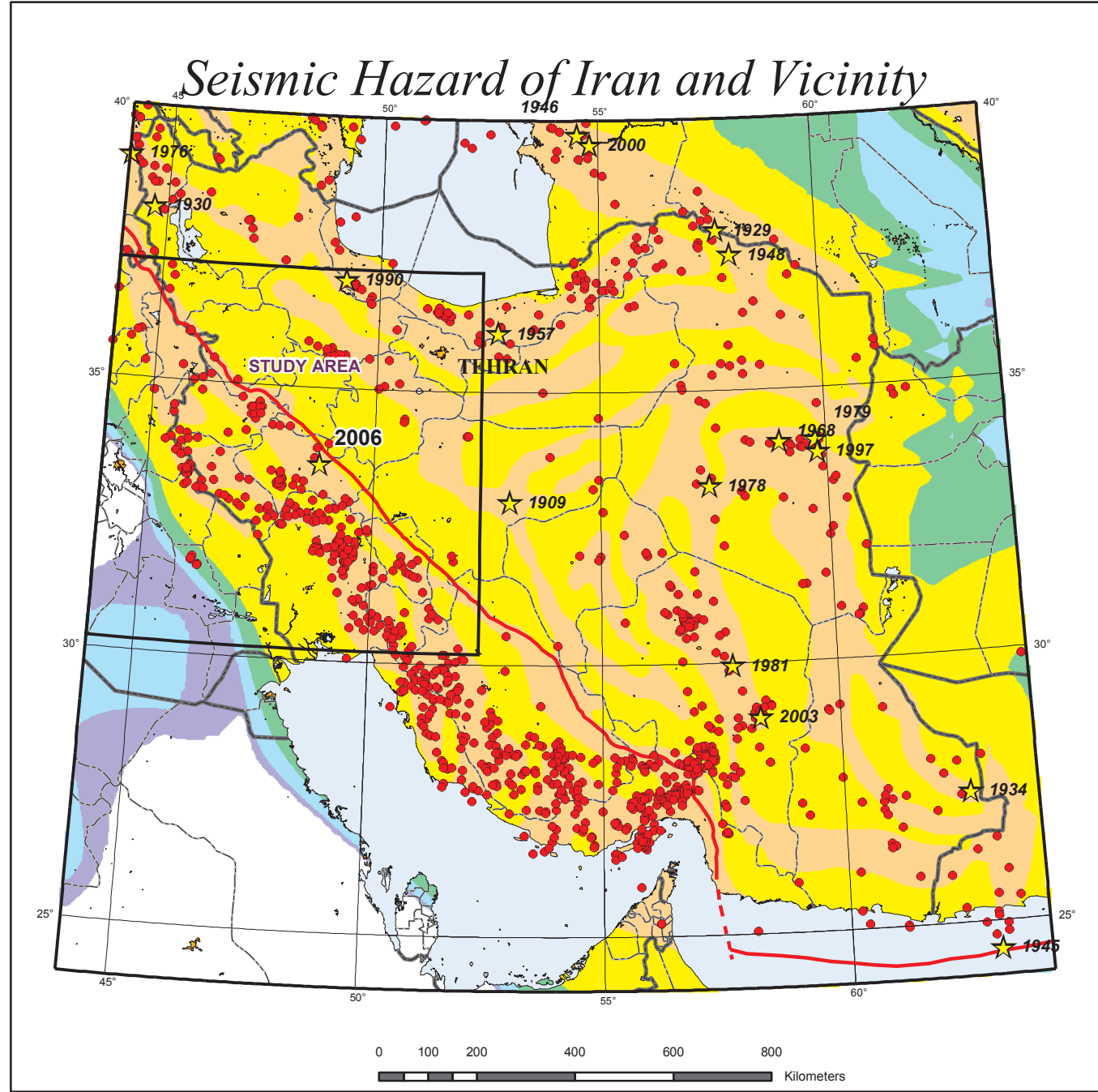
0.8 - 1.6

1.6 - 3.2

3.2 - 6.4

— Plate Boundary

Seismic hazard is expressed as peak ground acceleration (PGA) in meters/sec² expected in a 50-yr period with a probability of 10 percent.



SELECTED HISTORICAL EARTHQUAKES (400 BCE - 1899) IN THE STUDY AREA					
YEAR	MO	DY	LAT	LON	MAG
400	0	0	35.500	51.800	7.60
856	12	22	35.900	54.000	6.50
893	0	0	38.300	48.300	6.30
958	2	23	36.000	51.100	7.70
1042	11	4	38.200	46.300	7.60
1119	12	10	36.200	50.000	6.50
1301	0	0	36.200	53.400	6.50
1485	8	14	36.900	49.900	6.50
1608	4	20	36.500	50.600	6.50
1640	2	27	38.200	46.300	5.10
1721	4	26	37.900	46.700	7.70
1780	1	17	38.200	46.200	7.70
1800	0	0	36.200	53.300	6.50
1830	5	9	35.700	52.100	6.50
1890	7	11	36.500	54.900	6.50

TECTONIC SETTING

Iran lies in the wide boundary that separates the Arabia and Eurasia plates. This earthquake occurred as the result of stresses generated by the motion of the Arabian plate northward against the Eurasian plate at a rate of 2 to 3 cm/year (about one inch per year). Deformation of the Earth's crust in response to the plate motion takes place in a broad zone that spans the entire width of Iran and extends into Turkmenistan. Earthquakes occur primarily as the result of reverse faulting and strike-slip faulting within the zone of deformation. The March 31 earthquake occurred close to the Main Recent Fault, a major strike-slip fault, but we do not know at present if the earthquake occurred on that fault or on a related smaller fault.

The section of the Main Recent Fault near the epicenter of the March 31 earthquake produced a magnitude 7.4 earthquake in 1909.

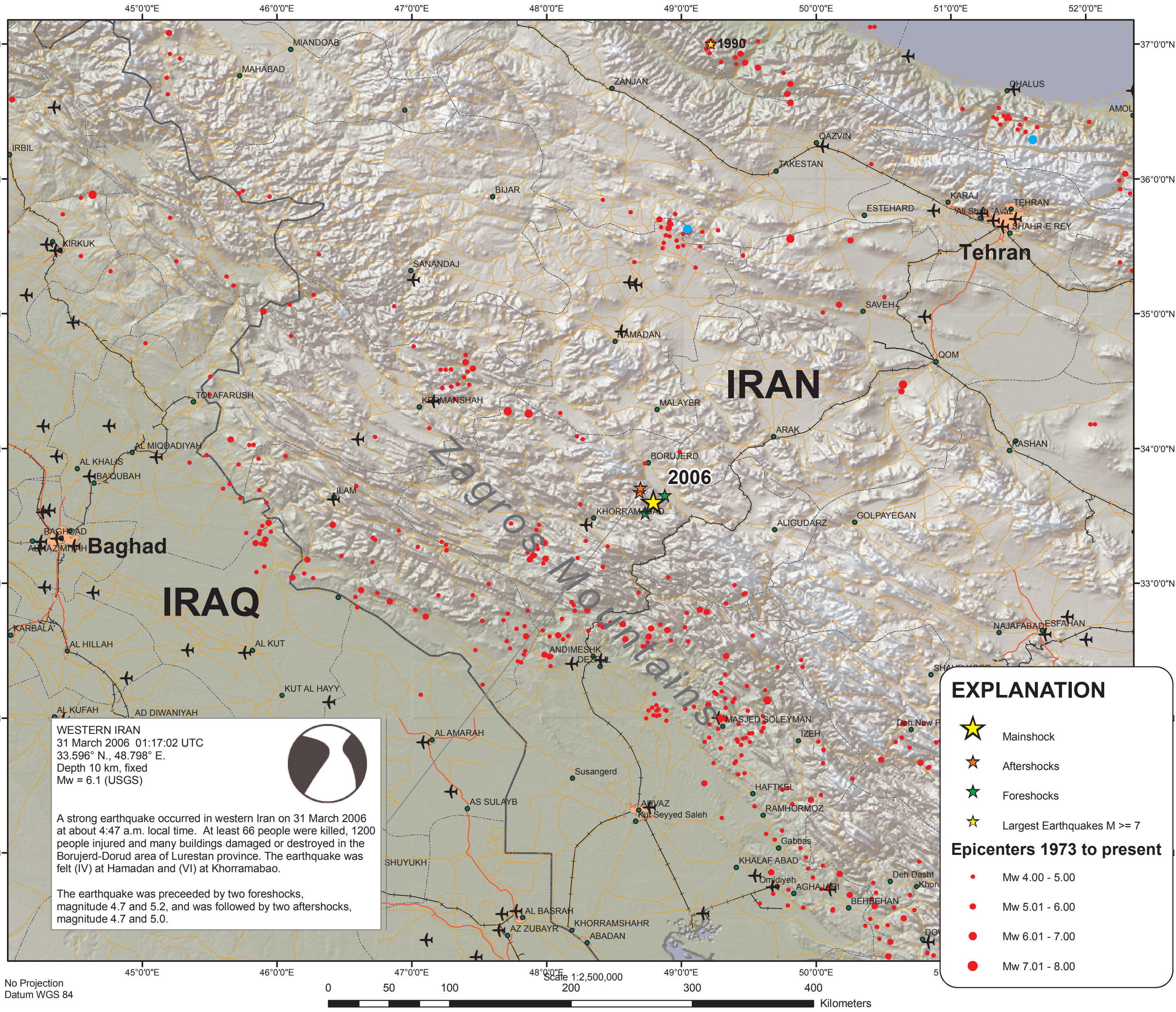
EARTHQUAKE HISTORY

Several severe earthquakes have occurred near this recent Iranian event. The most deadly was a magnitude 7.4 earthquake that struck on June 20, 1990, located about 175 km to the WNW of this recent event. This earthquake killed an estimated 40,000 to 50,000 people, injured more than 60,000, and left 400,000 or more homeless. There was extensive damage and landslides in the Rasht-Qazvin-Zanjan area and nearly all buildings in the Rudbar-Manjil area were destroyed. Another nearby devastating quake struck on September 1, 1962. This magnitude 7.3 quake killed about 12,000 people. More distant recent events include a February 28, 1997 magnitude 6.1 earthquake occurring about 300 km to the north (near the Armenia-Azerbaijan-Iran border), and a May 10, 1997 magnitude 7.3 event occurring about 1000 km to the east. The February 28th earthquake killed at least 1,100 people, injured 2,600, and left 36,000 homeless. The May 10th earthquake killed at least 1,567 people, injured 2,300, and left about 50,000 homeless. The Dec 26, 2003, Bam, Iran, earthquake killed over 30,000 people, injured over 30,000, and destroyed over 85 per cent of all buildings and infrastructure.

Other deadly earthquakes occurring in Iran include:

Date (UTC)	Magnitude	Comments
1957 12 13	7.3	130 killed *
1963 03 24	7.2	About 100 killed *
1983 07 22	5.6	3 killed, 41 injured
1990 06 21	5.8	At least 20 killed (aftershock of 1990 06 20)
1991 11 28	5.6	1 killed, 70 injured
2002 06 22	6.5	261 killed, 1300 injured
2003 12 26	6.8	30,000 killed, 30,000 injured
2004 05 28	6.3	20 killed, 150 injured

* Data from NOAA



EXPLANATION

★ Mainshock

★ Aftershocks

★ Foreshocks

★ Largest Earthquakes M $\geq$ 7

Epicenters 1973 to present

● Mw 4.00 - 5.00

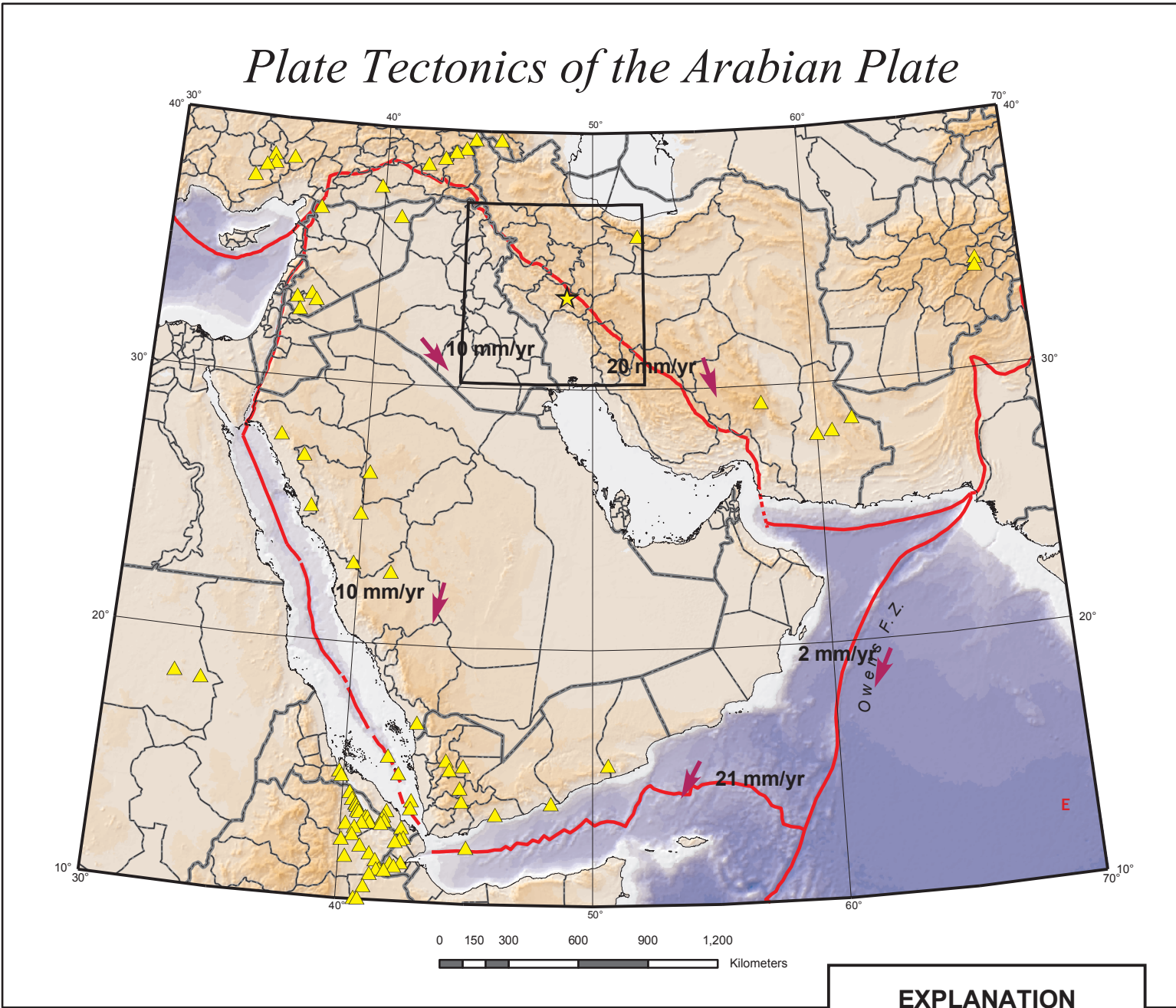
● Mw 5.01 - 6.00

● Mw 6.01 - 7.00

● Mw 7.01 - 8.00



MODERN EARTHQUAKES (1900 - 2002) IN THE STUDY AREA (M $\geq$ 6)					
YEAR	MO	DY	LAT	LON	MAG
1935	4	11	36.432	53.621	6.60
1957	7	2	36.090	52.701	7.10
1957	12	13	34.278	47.712	6.80
1958	8	16	34.259	47.869	6.50
1962	9	1	35.556	49.810	6.90
1978	11	4	37.673	48.911	6.30
1980	5	4	38.047	49.018	6.50
1980	12	19	34.476	50.646	6.10
1985	10	29	36.682	54.773	6.00
1990	6	20	37.006	49.218	7.40
1997	2	28	38.016	48.035	6.00
2002	6	22	35.616	49.050	6.50
2003	12	26	28.995	58.311	6.8
2004	5	28	36.29	53.61	6.3
2005	2	22	30.754	56.816	6.5
2005	11	27	26.774	55.858	6.1
2006	2	28	28.128	56.883	6.2



RELATIVE PLATE MOTIONS

The relative motion of adjacent tectonic plates is depicted on the map by short vectors at selected locations on the plate boundary. In this presentation, one plate, called the reference plate, is assumed to be rigid and fixed. The vector therefore represents the direction of the moving plate relative to the reference plate. The rate of relative motion is labeled next to the vector.

The components of the vector perpendicular and parallel to the plate margin approximate convergent/divergent and transverse direction of motion between the plates, respectively. As viewed from the reference plate, an inward directed component suggests compression at and near the plate boundary that may be expressed as crustal folding, uplift, thrust faulting, or plate subduction. Similarly, an outward directed component suggests plate divergence such as would be expected at a zone of crustal spreading. Transcurrent or transform faulting would be expected when the predominant vector component is parallel to the plate margin.

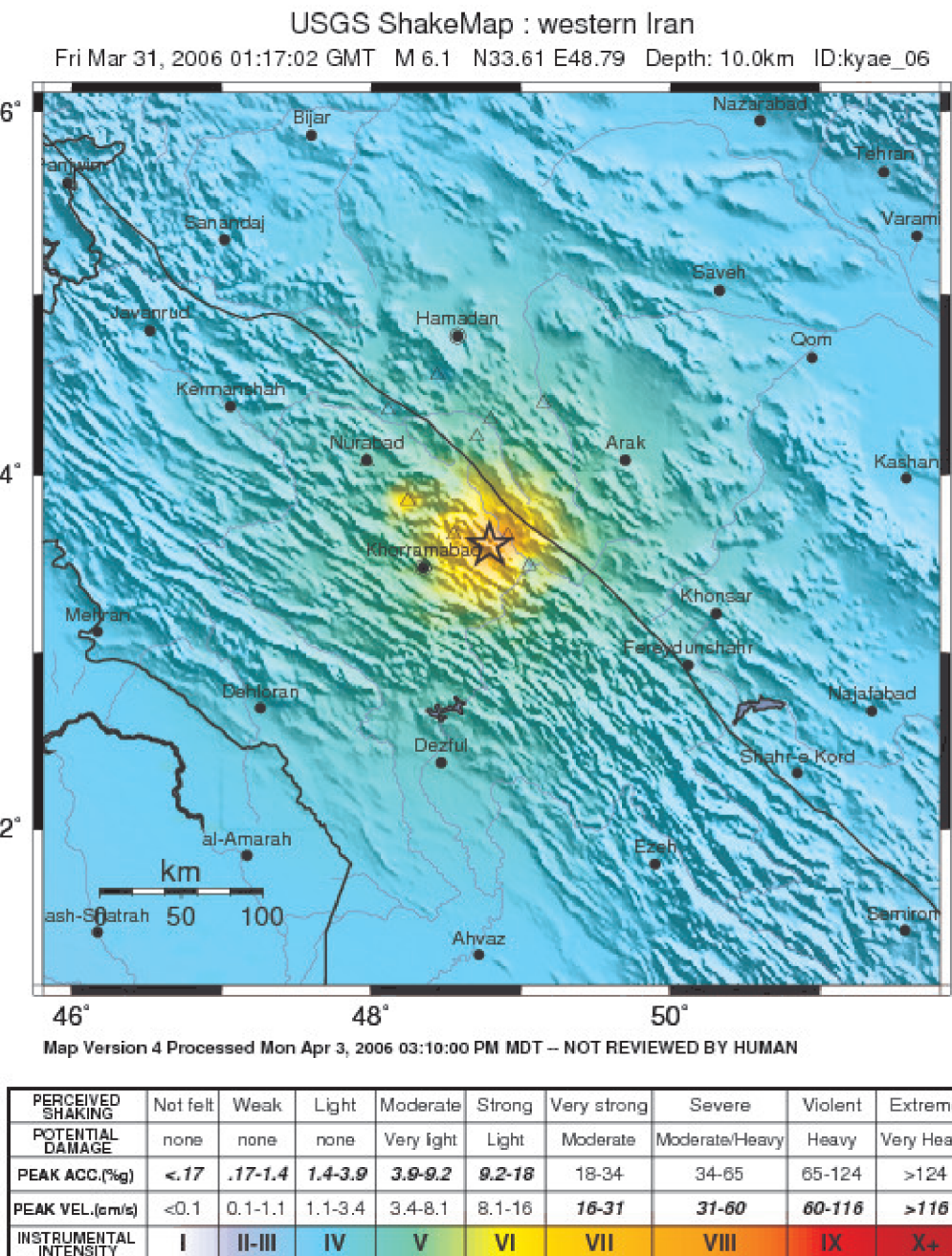
As an example, the relative plate motion vector in Iran along the Zagros Mtns. suggests both compression and right-lateral motion of the Eurasian plate against the Arabian Plate margin. The rate (20 mm/yr) is relatively high in this area and explains the frequent occurrence of large earthquakes in SW Iran. Conversely, the vector in the Gulf of Aden represents relatively rapid divergence at a rifted spreading zone and nearby transverse motion on short transform fault segments bounding the African Plate. Finally, in the Arabian Sea, the slow (2 mm/yr) rate and nearly parallel relative motion vector against the Indian Plate are consistent with right-lateral displacements along the Owens Fracture Zone where the seismicity is low.

DATA SOURCES

Seismicity
National Earthquake Information Center (2000 - 2002)
IASPEI Int'l Handbook of Earthquake Engineering and Seismology (1900 - 1999)
NOAA, NGDC (pre-1900)
Press reports (casualties and damage)
Seismic Hazard
GSHAP (1999 map)
Tectonics and Geology
University of Texas (plate boundaries)
Smithsonian Institution, Global Volcano Research Program (volcanoes)
NUVEL-1 (plate motions)
Base Maps
NIMA and ESRI, Digital Chart of the World
NOAA, NGDC, ETOPO2 (digital elevation model)
WSI, Inc. (topographic image)

DISCLAIMER

This map is preliminary and has not been edited for conformity with U.S. Geological Survey standards. Base map data, such as place names and political boundaries, are the best available but may not be current or may contain inaccuracies and therefore should not be regarded as having official significance.



Map Version 4 Processed Mon Apr 3, 2006 02:10:30 PM MDT - NOT REVIEWED BY HUMAN									
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate-heavy	Heavy	Very heavy
PEAK ACC. (g)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
PEAK VEL. (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+